HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
Re-Accredited with A++ Grade by NAAC (3rd Cycle)
Uthamapalayam - 625 533.

PG & RESEARCH DEPARTMENT OF

PHYSICS

PART IV - PHYSICS

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE)

With

Outcome Based Education (OBE)

(Academic Year 2023 -2026)

Semester – I

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UPHSE11	Physics for Everyday Life (NME)	2	25	75	100	2
	23UPHFN11	Introductory Physics	2	25	75	100	2

Semester – II

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UPHSE21	Astrophysics (NME)	2	25	75	100	2
	23UPHSE22	Digital Photography	2	25	75	100	2

Semester – III

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UPHSE31	Communication Physics	1	25	75	100	1
	23UPHSE32	Energy Physics	2	25	75	100	2
	23UGEVS41	Environmental Science	1	-	-	-	-

Semester – IV

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UPHSE41	Medical Instrumentation	2	25	75	100	2
	23UPHSE42	Materials Science	2	25	75	100	2
	23UGEVS41	Environmental Science	1	25	75	100	2

Semester – V

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UGVED51	Value Education	2	25	75	100	2
	23UPHIS51	Internship/Industrial Training	-	-	-	-	2

Semester – VI

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max Marks	Credits
Part - IV	23UPHSE61	Problems in Physics	2	25	75	100	2

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE11	PHYSICS FOR EVERYDAY LIFE (NME)	NME	2	2	25	75	100

Learning Objectives		
L1	To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics	
UNIT	**Contents**	**No. of Hours**
I	**MECHANICAL OBJECTS: s**pring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.	6
II	**OPTICAL INSTRUMENTS AND LASER:** vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – color photography – holography and laser.	6
III	**PHYSICS OF HOME APPLIANCES:** bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners	6
IV	**SOLAR ENERGY:** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.	6
V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS:** C.V. Raman, HomiJehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Recognize and apply physics principles used in mechanical objects encountered daily.	K1,K2,K3,K4
2	Explain the physics behind optical instruments and laser applications in everyday items.	K1,K2,K3,K4, K5,K6
3	Understand the functioning and physical principles of household appliances.	K1,K2,K3,K4, K5,K6
4	Describe the fundamentals and applications of solar energy.	K1,K2,K3,K4, K5,K6
5	Appreciate the contributions of Indian physicists to the field of physics and technology.	K1,K2,K3,K4, K5

Textbooks	
1.	The Physics in our Daily Lives, Umme Ammara, Gugu cool Publishing, Hyderabad, 2019.
2.	For the love of physics, Walter Lawin, Free Press, New York, 2011.
Reference Books	
1.	*Physics of Everyday Phenomena* by W. Thomas Griffith and Juliet Brosing, McGraw-Hill Education, 2014.

2.	*How Things Work: The Physics of Everyday Life* by Louis A. Bloomfield, Wiley, 2021.
3.	*Everyday Physics: Modern Classical Physics Made Simple* by Jo Hermans, Leiden University Press, 2012.
Web Resources	
1.	https://www.physicsclassroom.com/class/circles
2.	https://www.optics4kids.org/
3.	https://www.howstuffworks.com/
4.	https://www.youtube.com/watch?v=zY7QKI1HjaY

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO 1	3	2	2	1	3	2	2	3	2	1
CO 2	2	3	3	3	2	1	3	2	3	2
CO 3	3	2	2	1	3	2	3	3	3	1
CO 4	2	3	3	3	1	3	2	2	3	2
CO 5	3	2	1	3	3	3	2	3	3	1

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	2	1
CO2	1	3	2	3	2
CO3	2	3	3	3	1
CO4	3	2	2	3	2
CO5	3	2	3	3	1

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHFN11	INTRODUCTORY PHYSICS	Foundation Course	2	2	25	75	100

Learning Objectives		
L1	To help students get an overview of Physics before learning their core courses. To serve as a bridge between the school curriculum and the degree programme.	
UNIT	Contents	No. of Hours
I	**Vectors, scalars** –examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants	6
II	**Different types of forces**–gravitational, electrostatic, magnetic, electromagnetic, nuclear –mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces	6
III	**Different forms of energy**– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources–real life examples	6
IV	**Types of motion**– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – stream line and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations	6
V	**Surface tension** – shape of liquid drop – angle of contact – viscosity –lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use-conductors, insulators – thermal and electric	6
VI	**PROFESSIONAL COMPONENTS:** expert lectures –seminars – webinars – industry inputs – social accountability – patriotism	
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Apply concept of vectors to understand concepts of Physics and solve problems.	K1,K2,K3,K4
2	Appreciate different forces present in Nature while learning about phenomena related to these different forces.	K1,K2,K3,K4,K5,K6
3	Quantify energy in different process and relate momentum, velocity and energy.	K1,K2,K3,K4,K5,K6
4	Differentiate different types of motions they would encounter in various courses and understand their basis.	K1,K2,K3,K4,K5,K6
5	Relate various properties of matter with their behavior and connect them with different physical parameters involved.	K1,K2,K3,K4,K5
Textbooks		
1.	D.S. Mathur, 2010, ***Elements of Properties of Matter***, S.Chand and Co	
2.	Brijlal and N. Subrahmanyam, 2003, ***Properties of Matter***, S.Chand and Co.	
Reference Books		

1.	H.R. Gulati, 1977, ***Fundamental of General Properties of Matter***, Fifth edition, S.Chand and Co.
Web Resources	
1.	http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://science.nasa.gov/ems/
2.	https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	2	2
CO3	3	3	2	3	2
CO4	3	3	2	2	2
CO5	3	3	2	2	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE21	ASTROPHYSICS (NME)	NME	2	2	25	75	100

Learning Objectives		
L1	This course intends to introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research	
UNIT	**Contents**	**No. of Hours**
I	**TELESCOPES:** Optical telescopes – magnifying power, brightness, resolving power and f/a ratio – types of reflecting and refracting telescopes – detectors and image processing – radio telescopes – Hubble space telescope.	6
II	**SOLAR SYSTEM:** Bode's law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud – detection of gravitational waves – recent advances in astrophysics.	6
III	**ECLIPSES:** types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits. **THE SUN:** physical and orbital data – solar atmosphere – photosphere – chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.	6
IV	**STELLAR EVOLUTION:** H-R diagram – birth and death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae. **GALAXIES:** classification of galaxies – galaxy clusters –interactions of galaxies, dark matter and super clusters – evolving universe.	6
V	**ACTIVITIES IN ASTROPHYSICS:** (i) Basic construction of telescope (ii) Develop models to demonstrate eclipses/planetary motion (iii) Night sky observation (iv) Conduct case study pertaining to any topic in this paper (v) Visit to any one of the National Observatories Any three activities to be done compulsorily.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	**On completion of this course, students will**	
1	Identify and understand various types of telescopes and their functions.	K1,K2,K3,K4
2	Describe the structure and components of the solar system and recent advances in detecting celestial phenomena.	K1,K2,K3,K4, K5,K6
3	Explain eclipse phenomena and the physical features of the Sun.	K1,K2,K3,K4, K5,K6
4	Analyze star evolution, galaxy types, and the concept of dark	K1,K2,K3,K4,

	matter.	K5,K6
5	Engage in practical activities related to astrophysical concepts.	K1,K2,K3,K4, K5
Textbooks		
1.	Baidyanath Basu, (2001). An introduction to Astrophysics, Second printing, Prentice – Hall of India (P) Ltd, New Delhi	
2.	K.S. Krishnaswamy, (2002), Astrophysics – a modern perspective, New Age International (P) Ltd, New Delhi.	
3.	Shylaja, B.S. and Madhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,	
Reference Books		
1.	Dr.A.Mujiber Rahman,(2018) Introduction to Astrophyics, KAMS Publications,Theni	
2.	Carroll, B. W., & Ostlie, D. A. (2017). *Introduction to Modern Astrophysics.* Pearson, Boston.	
3.	Choudhuri, A. R. (2010). *Astrophysics for Physicists*. Cambridge University Press, Cambridge.	
Web Resources		
1.	https://science.nasa.gov/astrophysics/technology/ground-based-telescopes	
2.	https://www.nasa.gov/mission_pages/hubble/main/index.html	
3.	https://solarsystem.nasa.gov/	
4.	https://eclipse.gsfc.nasa.gov/	
5.	https://astro.unl.edu/naap/hr/animations/hr.html	
6.	https://www.esa.int/Science_Exploration/Space_Science/ Hubble_classifies_galaxies	
7.	https://www.skyandtelescope.com/astronomy-equipment/how-to-build-your-own-telescope/	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	3	2	1	3	2	3
CO 2	2	3	3	3	2	1	3	2
CO 3	3	2	3	2	3	2	3	3
CO 4	2	3	3	2	1	3	2	3
CO 5	3	1	2	3	2	3	3	2

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	3
CO2	1	3	2	3	2
CO3	2	3	3	2	3
CO4	3	2	3	3	2
CO5	3	3	2	3	1

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE22	DIGITAL PHOTOGRAPHY	SEC	2	2	25	75	100

Learning Objectives		
L1	To understand the principles of photography and image formation and the science and arts behind it. To understand the essential components of conventional and digital cameras and also the different image processing techniques.	
UNIT	**Contents**	**No. of Hours**
I	**PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION:** principle –chemical route and digital route –light, wavelengths, colors – shadows – light intensity and distance – making light form images –pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole – focal length and image size – imaging of closer subjects.	6
II	**LENSES – CONTROLLING THE IMAGES:** photographic lens – focal length and angle of view **(***problems***)** – focusing movement – aperture and f-numbers **(***problems***)** – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care.	6
III	**CAMERA USING FILMS AND ITS TYPES:** camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera.	6
IV	**DIGITAL CAMERAS PRINCIPLE AND TYPES:** principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – color modes – file formats (TIFF, RAW and JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.	6
V	**THE DIGITAL IMAGE – POSTPRODUCTION:** hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness and contrast – color balance – hue/saturation – dodge/burn – cloning and retouching – removing an element in an image – advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/light jet printers.	6
	Total	**30**
Textbooks		
1	Michel J. Langford, Anna Fox and Richard Sawdon Smith, ***Basic photography***, 9th Edn 2010-NL, Focal press, London.	
2	Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing.	
Reference Books		

1	Mark Galer, ***Digital Photography in Available Light essential skills***, 2006, Focal press, London.
2	Paul Harcourt Davies, ***The Photographer's practical handbook***, 2005, UK PRESS.

Web Resources	
1	https://nptel.ac.in

Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Learn in depth about types of lenses, their practical usages and other accessories used in photography	K1,K2,K3,K4
2	Describe and predict how images are formed and magnified	K1,K2,K3,K4, K5,K6
3	Appraise types of photographic components like shutter, aperture and its types.	K1,K2,K3,K4, K5,K6
4	Learn in depth about types of picture quality and types of storage devices	K1,K2,K3,K4, K5,K6
5	study the image enhancement techniques, image restoration procedures and the image compression procedures.	K1,K2,K3,K4, K5

Mapping with Programme Outcomes:

CO /PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**
CO 1	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	2	2	2
CO 3	3	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	2	2	2
CO 5	3	2	3	3	3	3	3	2	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	2
CO2	3	3	2	2	2
CO3	3	3	2	3	2
CO4	3	3	2	2	2
CO5	3	3	2	2	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE31	COMMUNICATION PHYSICS	SEC	1	1	25	75	100

Learning Objectives		
L1	To get a thorough knowledge on transmission and reception of radio waves, the different types of communication like Fibre optic, radio, radar, satellite, cellular	
UNIT	Contents	No. of Hours
I	**RADIO TRANSMISSION AND RECEPTION:** Transmitter – modulation types of modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation- essentials in demodulation – receivers: AM radio receivers – types of AM radio receivers – stages of super heterodyne radio receiver, advantages – FM receiver – difference between FM and AM receivers.	3
II	**FIBER OPTIC COMMUNICATION:** Introduction – basic principle of fiber optics – advantages – construction of optical fiber – classification based on the refractive index profile – classification based on the number of modes of propagation – losses in optical fibers – attenuation–advantages of fiber optic communication.	3
III	**RADAR COMMUNICATION: I**ntroduction - basic radar system – radar range – antenna scanning –pulsed radar system – search radar –tracking radar – moving target indicator Doppler effect-MTI principle – CW Doppler radar.	3
IV	**SATELLITE COMMUNICATION:** Introduction history of satellites – satellite communication system – satellite orbits – basic components of satellite communication system – commonly used frequency in satellite – communication–multiple access communication–satellite communication in India.	3
V	**MOBILE COMMUNICATION:** Introduction – concept of cell – basic cellular mobile radio system – cell phone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G (basic ideas).	3
	Total	**15**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Outline basic knowledge of methods of identifying various radio transmission methods.	K1,K2,K3,K4
2	Discuss the various methods of radio receivers, use these ideas to understand the use of radio propagation.	K1,K2,K3,K4,K5,K6
3	Extend the knowledge about the radar communication methods in our everyday life.	K1,K2,K3,K4,K5,K6
4	Interpret basic formulation of satellite technology using various	K1,K2,K3,K4,K5,K6

	methods and their uses.	
5	Relate the principles of various forms of mobile communication devices and their applications.	K1,K2,K3,K4,K5
Textbooks		
1.	V.K.Metha, ***Principles of Electronics***, S. Chand and Co Ltd., 2013.	
2.	Anokh Singh and Chopra A.K., ***Principles of communication Engineering***, S.Chand and Co, 2013.	
Reference Books		
1.	J.S. Chitode, ***Digital Communications***, 2020, Unicorn publications.	
2.	Senior John. M, ***Optical Fiber Communications***: Principles and Practice, 2009, Pearson Education.	
Web Resources		
1.	https://www.sciencedirect.com/topics/computer-science/radio-transmission	
2.	https://en.wikipedia.org/wiki/Radio#:~:text=The%20radio%20waves%20from%20 many,circuit%20and%20not%20passed%20on.	
3.	https://ieeexplore.ieee.org/document/7019537/	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	2	3	2	2	2	3	3	2	2
CO 2	2	3	2	3	2	3	2	2	3	3
CO 3	3	2	3	3	3	2	3	3	2	2
CO 4	3	2	3	2	2	3	2	2	3	2
CO 5	3	2	3	2	3	3	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	3	2	2	3	2
CO5	3	2	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE32	ENERGY PHYSICS	SEC	2	2	25	75	100

Learning Objectives		
L1	To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.	
UNIT	**Contents**	**No. of Hours**
I	**INTRODUCTION TO ENERGY SOURCES:** Energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.	6
II	**SOLAR ENERGY:** Solar energy Introduction – solar constant – solar radiation at the Earth's surface –Solar radiation measurements –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells.	6
III	**WIND ENERGY**: Introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy.	6
IV	**BIOMASS ENERGY:** Introduction – classification – biomass conversion technologies –photosynthesis – fermentation - biogas generation –classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages and disadvantages.	6
V	**ENERGY STORAGE:** Importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.	6
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Outline basic knowledge of methods of identifying various energy resources.	K1,K2,K3,K4
2	Discuss the various methods of solar energy, use these ideas to understand the application of solar energy in everyday life.	K1,K2,K3,K4,K5,K6
3	Extend the knowledge about nature of wind energy production methods and utilization.	K1,K2,K3,K4,K5,K6
4	Interpret basic formulation of biomass energy using various methods and their uses.	K1,K2,K3,K4,K5,K6
5	Relate the principles of various forms of energy storage devices and their applications.	K1,K2,K3,K4,K5
Textbooks		
1.	G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn.	

2.	S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn.
3.	D P Kothari, K P Singal, Rakesh Rajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.
Reference Books	
1.	John Twidell and Tony Weir, Renewable Energy Resources, Taylor and Francis, 2005, 2ndEdn.
2.	S.A.Abbasi and Nasema Abbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008.
3.	M. P. Agarwal, Solar Energy, S. Chand and Co. Ltd., New Delhi,1982.
4.	H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers, 1986.
Web Resources	
1.	https://www.britannica.com/science/solar-energy#:~:text=Top% . 20Questions-,What%20is%20solar%20energy?, current%20and% 20anticipated%20energy%20requirements
2.	https://windexchange.energy.gov/what-is-wind
3.	https://www.eia.gov/energyexplained/biomass/#:~:text=Biomass% E2%80%94r enewable%20energy%20from%20plants, countries%20for%20cooking%20 and%20heating

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	2	3	2	2	2	3	3	2	2
CO 2	2	3	2	3	2	3	2	2	3	3
CO 3	3	2	3	3	3	2	3	3	2	2
CO 4	3	2	3	2	2	3	2	2	3	2
CO 5	3	2	3	2	3	3	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	3	2	2	3	2
CO5	3	2	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE41	MEDICAL INSTRUMENTATION	SEC	2	2	25	75	100

Learning Objectives		
L1	This course aims to provide background of the Physics principles in medical instrumentation technologies through theoretical and practical learning.	
UNIT	**Contents**	**No. of Hours**
I	**BIOMETRICS:** Introduction to man-instrument system and its components – problems encountered in measuring living systems – transducers– force, motion, pressure transducers. AUDIOMETRY: Mechanism of hearing – air and bone conduction – threshold of hearing – audiometer – masking in audiometry – pure tone and speech audiometer – evoked response audiometry – hearing aids	6
II	**BIOELECTRIC POTENTIALS AND ELECTRODES:** Biomedical signals – sources of bioelectric potentials – resting, action and propagation of bioelectric potentials –bio-potential electrodes – skin surface, needle electrodes. **BIOMEDICAL RECORDERS:** Electro-conduction system of heart – electro cardiogram (ECG) – Einthoven's triangle – electro encephalogram (EEG) –brain waves – EEG instrumentation – recording of evoked potentials – electro myogram (EMG)–pulse oximeter.	6
III	**DIAGNOSTIC RADIOLOGY:** Radiography – primary radiological image – contrast agents, filters – beam restrictor, grid – image quality. **COMPUTED TOMOGRAPHY:** Linear tomography – computed tomography – helical and multi slice – image quality– radiation dose. **RADIOISOTOPES AND NUCLEAR MEDICINE:** Radioisotopes – radiopharmaceuticals – technetium generator – gamma camera – positron emission tomography – disposal of radioactive waste.	6
IV	**ULTRASOUND IMAGING:** Ultrasound transducer – ultrasound imaging– Doppler ultrasound – ultrasound image quality and bio-effects. **MAGNETIC RESONANCE IMAGING:** Proton and external magnetic field – precession – radiofrequency and resonance – MRI signal – relaxation time – MRI instrumentation – imaging sequences – biosafety.	6
V	**PROJECT ASSIGNMENT:** Clinical practice of *one* of the following: electro cardiogram, electro encephalogram, electro myogram, electro oculogram, computed tomography, positron emission tomography, ultrasound.	6
	Total	
Course Outcomes		**Knowledge Level**

CO	On completion of this course, students will	
1	Outline basic knowledge of methods of biometric and audiometry to understand the basics physiology.	K1,K2,K3,K4
2	Discuss the various methods of biomedical recorders, use these ideas to understand the use of biomedical instruments.	K1,K2,K3,K4,K5,K6
3	Extend the knowledge about the CT scan and nuclear medicines in our everyday life.	K1,K2,K3,K4,K5,K6
4	Interpret basic formulation of ultrasound and MRI scan using various methods and their uses.	K1,K2,K3,K4,K5,K6
5	Relate the principles of various biomedical instrumentation by doing a project work.	K1,K2,K3,K4,K5
Textbooks		
1.	Leslie Cromwell, Fred Weibell, Erich Pfieffer (2002) ***Biomedical Instrumentation and Measurements*** Prentice Hall of India, New Delhi.	
2.	R. S. Khandpur (2003) ***Handbook of Biomedical Instrumentation*** 2nd Edn. Tata McGraw Hill, New Delhi.	
3.	Kuppusamy Thayalan (2017), ***Basic Radiological Physics*** 2nd Edn. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.	
Reference Books		
1.	John Webster (2004) ***Bioinstrumentation*** John Wiley and Sons, Singapore.	
2.	John Enderle, Susan Blanchard, Joseph Bronzino (2005) ***Introduction to Biomedical Engineering***, 2nd ed. Elsevier, San Deigo.	
3.	William Hendee, Geoffrey Ibbott, Eric Hendee (2005) ***Radiation therapy*** Physics 3rd ed. Wiley-Liss, New Jersey.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Biometrics#:~:text= Biometrics%20are%20body %20 measurements%20and%20calculations%20related, individuals%20in% 20groups%20that%20are%20under%20surveillance	
2.	https://medlineplus.gov/ency/article/007451.htm#:~:text=Information& text= Diag nostic%20radiology%20helps%20health%20care,colon%20cancer%2C% 20or%20 heart%20disease	
3.	https://www.fda.gov/radiation-emitting-products/medical-imaging/ultrasound-imaging#:~:text=Ultrasound%20imaging%20(sonography)%20uses%20high,ultr asound%20(to%20visualize%20breast%20tissue)	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	2	3	2	2	2	3	3	2	2
CO 2	2	3	2	3	2	3	2	2	3	3
CO 3	3	2	3	3	3	2	3	3	2	2
CO 4	3	2	3	2	2	3	2	2	3	2
CO 5	3	2	3	2	3	3	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	3	2	2	3	2
CO5	3	2	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE42	MATERIALS SCIENCE	SEC	2	2	25	75	100

Learning Objectives		
L1	To learn imperfections in crystals, deformation of materials and testing of materials.	
L2	To get knowledge on behaviour of a material, under the action of light and their applications.	
L3	To know the applications of crystal defects.	
UNIT	**Contents**	**No. of Hours**
I	**CRYSTAL IMPERFECTIONS:** Introduction–point defects: vacancies (*problems*), interstitials, impurities, electronic defects–equilibrium concentration of point imperfections (*problems*)–application of point defects –line defects: edge dislocation (*problems*), screw dislocation – surface defects: extrinsic defects – intrinsic defects: grain boundaries, tilt and twist boundaries, twin boundaries, stacking faults – volume defects – effect of imperfections.	6
II	**MATERIAL DEFORMATION:** Introduction – elastic behavior of materials – atomic model of elastic behavior –modulus as a parameter in design – rubber like elasticity – inelastic behavior of materials – relaxation process – viscoelastic behavior of materials – spring-Dash pot models of viscoelastic behavior of materials.	6
III	**PERMANENT DEFORMATION AND STRENGTHENING METHODS OF MATERIALS:** Introduction –plastic deformation: tensile stress-strain curve – plastic deformation by slip – creep: mechanism of creep – creep resistant materials – strengthening methods: strain hardening, grain refinement – solid solution strengthening – precipitation strengthening.	6
IV	**OPTICAL MATERIALS:** Introduction – optical absorption in metals, semiconductors and insulators – NLO materials and their applications – display devices and display materials: fluorescence and phosphorescence – light emitting diodes – liquid crystal displays.	6
V	**MECHANICAL TESTING:** Destructive testing: tensile test, compression test, hardness test – non destructive testing (NDT): radiographic methods, ultrasonic methods – thermal methods of NDT: thermography – equipment used for NDT: metallurgical microscope.	6
	Total	**30**
Course Outcomes		**Knowledge Level**
CO	**On completion of this course, students will**	
1	Outline basic knowledge of methods of crystal imperfection to study the crystal defects.	K1,K2,K3,K4

2	Discuss the various methods of behaviour of materials, use these ideas to understand the use of different types of metals.	K1,K2,K3,K4,K5,K6
3	Extend the knowledge about deformation and strengthening of materials apply all these in our everyday life.	K1,K2,K3,K4,K5,K6
4	Interpret basic formulation of Nonlinear optical devices and their uses.	K1,K2,K3,K4,K5,K6
5	Relate the principles of various types of mechanical testing of materials.	K1,K2,K3,K4,K5
Textbooks		
1.	***Material science and Engineering***, Raghavan V, Prentice Hall of India, Sixth Edition, 2015.	
2.	***Materials science***, V. Rajendran, McGraw Hill publications 2011.	
Reference Books		
1.	William D. Callister, Jr., Material Science and Engineering – An Introduction, 8th Edition, John Wiley and Sons, Inc., 2007.	
2.	W. Bolton, ***"Engineering materials technology",*** 3rd Edition, Butterworth and Heinemann, 2001.	
3.	Donald R. Askeland, Pradeep P. Phule, ***"The Science and Engineering of Materials"***, 5th Edition, Thomson Learning, First Indian Reprint, 2007.	
4.	William F. Smith, ***"Structure and Properties of Engineering Alloys",*** Mc-Graw-Hill Inc., U.S.A, 2nd edition, 1993.	
Web Resources		
1.	https://www.britannica.com/science/crystal-defect #:~: text = crystal % 20 defect%2C%20 imperfection%20in%20the,or%20neutrons)% 20striking %20the%20solid	
2.	https://en.wikipedia.org/wiki/Deformation_(engineering)	
3.	https://en.wikipedia.org/wiki/Optical_Materials	

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	2	3	2	2	2	3	3	2	2
CO 2	2	3	2	3	2	3	2	2	3	3
CO 3	3	2	3	3	3	2	3	3	2	2
CO 4	3	2	3	2	2	3	2	2	3	2
CO 5	3	2	3	2	3	3	2	3	3	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	2
CO2	3	2	2	3	3
CO3	2	3	3	2	2
CO4	3	2	2	3	2
CO5	3	2	3	3	3

Strong-3 Medium-2 Low-1

Course Code	Course Title	Category	Credits	Hours	Marks		
					CIAE	TEE	Total
23UPHSE61	PROBLEMS IN PHYSICS	SEC	2	2	25	75	100

Learning Objectives		
L1	The course aims to enhance students' problem-solving skills by applying fundamental physics principles to a variety of competitive exam problems while reinforcing their understanding of key concepts in major topics in physics to develop analytical thinking and effective problem-solving strategies.	
UNIT	**Contents**	**No. of Hours**
I	**CLASSICAL MECHANICS:** Newton's Laws of Motion - First, Second, and Third Laws: Concepts and Applications - Examples: Recoil of a Gun, Rocket Propulsion - Work, Energy - Conservation of Energy - Momentum and Collisions - Conservation of Linear Momentum - Elastic and Inelastic Collisions- Oscillations and Wave- Electromagnetic wave.	6
II	**ATOMIC AND NUCLEAR PHYSICS:** Atomic Structure of atom - Bohr Model of the Hydrogen Atom - Energy Levels and Spectral analysis of Bohr, Sommerfeld and Vector atom model-Stern-Gerlach experiment - Nuclear Physics – Basic properties of the Nucleus—Nuclear energy and Nuclear forces- Liquid drop model-Binding Energy and Mass Defect - Nuclear Fission.	6
III	**WAVE MECHANICS:** Wave-Particle Duality – Planck's theory of Blackbody radiation -Photoelectric effect -Phenomenon of scattering- De Broglie Hypothesis - Matter Waves – Heisenberg Uncertainty principle-Introduction to Operator and Schrödinger Equation -Simple applications.	6
IV	**SOLID STATE PHYSICS:** Crystal Structure and Lattice Theory - Unit Cells, Crystal Lattices - Bravais Lattices and Miller Indices -Diffraction of waves and particles – Basic Electrical and Optical properties of Materials - Conductors, Semiconductors, Insulators.	6
V	**ELECTRONICS:** Ohm's Law and Kirchhoff's Laws - Application to Simple Circuits - PN Junction Diode – Bridge Rectifier - Bipolar Junction Transistor (BJT) in CE Configuration- AND, OR and NOT gates (DTL) - Single Stage Amplifier - Hartley Oscillator - Operational Amplifiers (Op-Amps) - Adder, Subtractor, Differentiator and Integrator - Inverting and Non-Inverting Amplifiers -Logic gates -AND, OR, NOT- SR Flip-Flops.	6
	Total	**30**

Course Outcomes		Knowledge Level
CO	On completion of this course, students will	
1	Understand and apply the fundamental principles of Classical Mechanics to solve real-world problems involving motion, forces, and energy.	K1,K2,K3,K4
2	Comprehend the atomic and nuclear structure, types of radioactive decay, and nuclear reactions to solve problems in Modern Physics.	K1,K2,K3,K4,K5,K6
3	Apply the principles of Wave Mechanics to understand	K1,K2,K3,K4,K5,K6

	quantum phenomena and solve related problems using Schrödinger's equation.	
4	Analyze the fundamental concepts of Solid State Physics, including crystal structures and magnetic properties, and apply them to solve basic problems in material science.	K1,K2,K3,K4,K5,K6
5	Develop foundational knowledge of analog and digital electronics, including circuit analysis and digital logic, to solve basic electronics problems.	K1,K2,K3,K4,K5

Textbooks	
1.	A to Z Physics for NEET ,Cengage Publishers,2021.
2.	Sehgal, Chopra, Sehgal, Modern Physics, Sultan Chand & Sons, 2004
3.	M.A. Wahab, Numerical Problems in Solid State Physics, Narosa publishing House Pvt. Ltd., 2011.
4.	V.K. Metha, Principles of Electronics, S. Chand and Co. Ltd., 2
Reference Books	
1.	David Halliday, Robert Resnick, and Jearl Walker, Fundamentals of Physics, Wiley publishers, 2018.
2.	Jyotirmoy Guha, Quantum mechanics (Theory, Problems and Solutions), Books and Allied(P) LTD,2012.
3.	Jyotirmoy Guha, Solid State Physics (Theory, Problems and Solutions), Books and Allied(P) LTD,2012.
4.	I.E. Irodov, Problems in General Physics, CBS publishers Pvt. Ltd., 2019.
5.	D.C. Tayal, University Physics, Himalaya Publishing House, 2012
6.	A. P. Godse and U.A. Bakshi, Electron devices and circuits,Technical publications,2003
Web Resources	
1.	https://archive.org/details/pinsky-problems-in-physics
2.	https://phys.libretexts.org/Courses/University_of_California_ Davis/UCD%3A_Classical Mechanics/1%3A_Motion/Sample_Problems

Mapping with Programme Outcomes:

CO /PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	3	3	2	3	2	3
CO 2	3	2	3	3	3	3	3	2
CO 3	3	3	2	3	3	2	2	3
CO 4	2	3	3	2	3	3	3	2
CO 5	3	3	3	3	3	3	2	3

Strong-3 Medium-2 Low-1

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	3	2
CO2	3	2	3	2	3
CO3	2	3	2	3	2
CO4	3	2	3	2	3
CO5	3	3	3	3	3

Strong-3 Medium-2 Low-1